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TEXT: *U* ENTIRE. THE SOVIETS ARE DEVELOPING A FAMILY OF SOPHISTICATED ELECTRONIC SENSORS AND OTHER DEVICES THAT OPERATE ON PRINCIPLES DERIVED FROM BIOSYSTEMS. THE GOAL IS TO CAPITALIZE ON TECHNOLOGICAL PROCESSES AND CHARACTERISTICS THAT HAVE BEEN PERFECTED (AND ARE EFFECTIVE) AS LIVING SYSTEMS.

U THIS SOVIET EFFORT IN BIONICS WAS ACCELERATED IN THE 1960'S WITH ORGANIZED THRUSTS IN THE FOLLOWING SPECIFIC AREAS: 1. RESEARCH INTO RECEPTORS AND ANALYZERS AND WORK ON PATTERN RECOGNITION (AS MODELED ON THE SENSORY ORGANS OF ANIMALS). 2. BASIC RESEARCH INTO AND MODELING OF NEURONS, NERVE NETWORKS, NERVE CENTERS, AND PRINCIPLES OF ORGANIZATION OF THE BRAIN OF LIVING ORGANISMS, WITH THE OBJECT OF EXPLORING THE PATHS FOR THEIR UTILIZATION IN TECHNICAL DEVICES AND SYSTEMS. 3. DEVELOPMENT OF NAVIGATION AND RADAR DEVICES AND MEANS OF COMMUNICATION ON THE BASIS OF NEW AND BETTER PRINCIPLES OBSERVED IN LIVING NATURE. 4. INVESTIGATING PROBLEMS OF BIOMECHANICS, BIOENERGETICS, AEROHYDRODYNAMICS, AND BIOCHEMISTRY (STUDYING ENERGY CONVERSION AND UTILIZATION AND ASSESSING THE EFFICIENCY OF BIOLOGICAL SYSTEMS AS A GUIDE TO ENHANCING THE EFFICIENCY OF MECHANICAL SYSTEMS). 5. GERMANE PROBLEMS, SUCH AS THE BIONIC ASPECTS OF THE MAN MACHINE PROBLEM, WHICH ON THE WHOLE PERTAIN TO ENGINEERING PSYCHOLOGY (HUMAN ENGINEERING), ARE EXEMPLIFIED BY THE DEVELOPMENT OF METHODS OF DETECTING AND EVALUATING THE PSYCHOPHYSIOLOGICAL POTENTIAL OF MAN, OPTIMAL METHODS OF TEACHING AND TRAINING, AND WAYS OF FACILITATING THE WORKING CONDITIONS OF HUMAN OPERATORS (I.E., OF BIOELECTRICAL SYSTEMS, CYBORGS, FOR THE CONTROL OF TECHNICAL SYSTEMS).

U EXAMPLES OF SOME OF THE PAYOFFS THAT ARE BEGINNING TO APPEAR IN THE LITERATURE ARE ELECTRONIC MODELS OF NERVE CELLS (SEE THE 7 JANUARY 1983 ISSUE OF THIS PUBLICATION, AST-2660P-267-83). A PHOTSENSITIVE BIOMEMBRANE (SEE THE PREVIOUS ARTICLE), AND ELECTRONIC MODELS OF THE EYE. MOREOVER, BIONIC CONCEPTS WERE PROBABLY USED IN THE DEVELOPMENT OF A SOVIET AIRBORNE THERMAL IMAGER.

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U THESE EFFORTS HAVE CREATED A NEED IN THE SOVIET UNION FOR ENGINEERS AND OTHER TECHNICAL PERSONNEL TRAINED IN BIONICS. CONSEQUENTLY, BIONICS HAS EMERGED AS AN INDEPENDENT SUBJECT TAUGHT IN MANY ENGINEERING SCHOOLS. A BOOK ENTITLED, BIONICS, BIOLOGICAL ASPECTS, PUBLISHED IN 1978, IS AN EXAMPLE OF A TEXT WRITTEN ESPECIALLY FOR ENGINEERS. THE FIVE BASIC FIELDS OF BIONICS COVERED IN THIS TEXT ARE: RECEPTION AND ANALYZER SYSTEMS, NEUROBIONICS, BIOMECHANICS, ORIENTATION AND NAVIGATION, AND BIOENERGETICS.

C COMMENT: SOVIET R-AND-D IN BIONICS MIGHT BE A SLEEPER THAT COULD SIGNIFICANTLY INFLUENCE FUTURE MILITARY SYSTEMS AND METHODS. WHILE WESTERN ANALYSTS TEND TO FOCUS ON SOVIET TECHNOLOGY GAINS WITHIN THE CONCEPTUAL DOMAIN FAMILIAR TO THE WEST, THE SOVIETS ALSO APPEAR TO BE FOLLOWING A PARALLEL TECHNOLOGY TRACK BASED ON BIONIC CONCEPTS. WITHIN GIVEN WEAPON SYSTEM AREAS (E.G., SMART WEAPONS AND FIRE AND FORGET SYSTEMS), WHERE THE INFORMATION ON THE TARGET AND TERRAIN TRAVERSED CAN BE KEPT TO A MINIMUM, THE SOVIET BIONIC CONCEPTS COULD OVERCOME MANY SHORTCOMINGS IN THEIR PRESENT COMPUTER TECHNOLOGY BY SUBSTITUTING ELEGANCE OF METHODS FOR COMPUTER POWER. IN PRINCIPLE, SIMILAR ADVANTAGES ARE POSSIBLE IN OTHER AREAS OF TECHNOLOGY. THESE TECHNIQUES COULD GREATLY ENHANCE THE FUTURE SOVIET ABILITY TO SURPASS THE U.S. IN MANY AREAS.

U COMMENT: THE SOVIETS COULD BENEFIT IN ANOTHER WAY FROM DEVICES THAT MIMIC LIVING SYSTEMS. COMPONENTS FROM LIVING SYSTEMS TEND NOT TO BE EXACTLY ALIKE. LIGHT SENSITIVE DETECTORS IN THE EYE, FOR EXAMPLE, DO NOT HAVE EXACTLY THE SAME SENSITIVITY. OTHER SENSORS ALSO DIFFER FROM EACH OTHER, YET SYSTEMS THAT CONTAIN THESE DETECTORS ARE HIGHLY EFFICIENT AND SUFFICIENTLY EFFECTIVE. SIMILARLY, THE COMPONENTS OF A BIONIC SYSTEM WOULD NOT NECESSARILY REQUIRE HIGH PRECISION IN MANUFACTURE AND COULD BE LESS EXPENSIVE TO MAKE THAN COMPONENTS IN COMPARABLE TRADITIONAL SYSTEMS.

U COMMENT: THE SOVIETS ARE ALSO VENTURING INTO WHAT THEY REFER TO AS THEORETICAL BIONICS. THE ACTION OF LIVING SYSTEMS FOLLOW A SET OF RULES THAT ARE NEITHER WHOLLY DETERMINISTIC NOR WHOLLY STATISTICAL. THE DEVELOPMENT OF THEORETICAL BIONICS WILL PROBABLY INCLUDE A SEARCH FOR THE RULES GOVERNING LIVING SYSTEM TECHNOLOGY

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PAGE

19
